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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09 909,488	07 20 2001	Harapanahalli S. Muralidhara	11936.15US01	2586

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EXAMINER

FORTUNA, ANA M

ART UNIT	PAPER NUMBER
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1723

DATE MAILED: 10 22 2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/909,488

Applicant's

Lee et al.

Examiner

Ana Fortuna

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.

If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.

If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.

Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED. 35 U.S.C. § 133.

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704 b.

## Status

1) ☒ Responsive to communication(s) filed on Jul 30, 2002

2a) ☒ This action is **FINAL**.

2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

## Disposition of Claims

4) ☒ Claim(s) 1-40 is/are pending in the application.

4a) Of the above, claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.

6) ☒ Claim(s) 1-40 is/are rejected.

7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.

8) Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on \_\_\_\_\_ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☐ All b) ☐ Some\* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) The translation of the foreign language provisional application has been received.

15) Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

1) Notice of References Cited (PTO-892)

4) Interview Summary (PTO-413) Paper No. s

2) Notice of Draftsperson's Patent Drawing Review (PTO-948)

5) Notice of Informal Patent Application (PTO-152)

3) Information Disclosure Statement(s) (PTO-1449) Paper No(s).

6) Other:

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## DETAILED ACTION

### *Claim Rejections - 35 U.S.C. § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-10, 12-25, 28-35, 37-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Caloundra et al.(5,766,479)(hereinafter '479). Reference '479 discloses the apparatus and process including a nanofiltration membrane within a housing as pretreatment for the reverse osmosis membrane process, the percent of rejection and hardness removal is also disclosed (column 6, lines 3-29). The membrane(s) water flow as claimed in claims 1, steps b) and c), claim 4, 8, 14, 21, 25, 29, 31, 39 is not expressly disclosed. It would have been obvious to one skilled in the art at the time the invention was made to use multiple membranes in the water softening apparatus of '479 to achieve a predetermined desired permeate flow. The use of a plurality of membrane for the intended purpose is cumulative. Regarding claims 2, 25, 34, 35 the operating pressure is disclosed by '479 (column 6, lines 7-9). As to claims 3, 22 the molecular weight cut-off is disclosed based on corresponding pore size range (column 6, lines 32-35). Concerning claims 5, 9, 16, 19, 20, 23, 30, 31, 37 and 40, the nanofiltration membrane (NF-40, NF70) having the capability of removing up to 80 % of hardness, e.g. calcium, magnesium,

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sulfate, and up to 40 % of monovalent ions, e.g. sodium and chloride ions is disclosed (column 6, lines 14-22). Higher removal can be expected as a total rejection when the apparatus is operated with multiple membranes. It would have been obvious to one skilled in the art to expect higher total removal in a device loaded with multiple nanofiltration units or units in series.

The rejection of divalent ions and partial rejection of monovalent ions is inherent of the nanofiltration membranes, its selectivity and pore size. As to claims 10, 24, 33 the rejection of divalent and partial rejection of monovalent ions by the nanofiltration membrane clearly suggest that the salt level in the input water is increased. Claim 1 is limited to producing water with "lower hardness than the output water", therefore, the high hardness water is retained by the nanofiltration membrane. Regarding claims 12, 27, although reference '479 is directed to treating potable water, the softening, or removal of divalent ions and other hardness ions present in potable water are expected to be removed by the membrane (nanofiltration), based on the rejection properties disclosed in '479 for the membrane.

3. Claims 1-10, 12-25, 28-35, 37-40 rejected under 35 U.S.C. 103(a) as being unpatentable over Cluff (5,234,583)(hereinafter '583). Reference '583 discloses the apparatus having a housing and a nanofiltration membrane and its use in water treatment (figures 2-3, column 1, lines 32-46). The operating pressure is also disclosed (column 1, lines 52-65). Using more than one nanofiltration membrane with molecular weight cut-off of lower than 200 is disclosed (column 1, lines 32-47, column 4, lines 36-43, column 3, lines 35-47). The particular flow is not disclosed, however, decreasing the size of the nanofiltration membranes to maintain appropriated flow

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velocity is suggested (column 3, lines 37-66). It would have been obvious to one skilled in the art at the time the invention was made to select the appropriate nanofiltration pore size and the number of modules in the device in order to produce a desired flow rate. The level of mono and divalent ion retentions and membrane properties are considered to be the same as in the membrane disclosed in reference 479, since both references suggest the same nanofiltration membranes, e.g. NF-70.

Claims 13, 28, and 38, the final water hardness level is dependent of the initial water hardness level, therefore, a low hardness level of the product should have been expected by the skilled artisan at the time the invention was made by using a membrane having 80 hardness rejection in a feed water having hardness level of 10 grain per gallons or lower, when the membrane of 479 is used as water softening.

4. Claims 11, 12, 19, 26, 27, 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Caloundra et al (5,766,479) or Cluff as applied to claims 1-10, 12-25, 28-35, and 37-40 above, and further in view of Linder et al (6,086,764) (hereinafter '764) and Raman et al (Consider Nanofiltration for Membrane separations) or Waite (5,147,553) (hereinafter '553). References 479 and 583 fail to disclose the nanofiltration membrane as positively charged. NF-40 and NF-70 are known in the art as negatively charged. Reference to Linder et al ('764) teaches nanofiltration membranes having positive charge (in addition to negative charge, e.g., amphoteric), and having a sodium chloride rejection lower than 50 %, and a molecular weight cut-off between 100 and 1500. (column 3, lines 27-42). The use of the membrane as a

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pretreatment for reverse osmosis in a water treatment process is also disclosed (column 10, lines 23-35). It would have been obvious to one skilled in the art at the time the invention was made to use a nanofiltration membrane having positive charge, as disclosed by '764, for the device for treating water disclosed in references '479 and '583, as suggested by '764, for low sodium salt rejection and high percentage removal of other water contaminants depending on molecular weight cut-off. The rejection of divalent ions, e.g. sulfate and magnesium is expected based on the negative charge, also present in the membrane of '764 (Linder et al). White ('553) teaches regarding claims 12 and 27, a nanofiltration membrane which can be provided within a housing as conventional, use for softening potable water (column 5, lines 55, abstract, column 22, lines 34-50), the membrane shows a low sodium chloride rejection, and rejection of magnesium sulfate higher than 90 % , e.g. 94 %, and high membrane flux, as claimed in claims 37, 19 (Table, columns 23-24, lines 19-30, example 10). It would have been further obvious to one skilled in the art at the time the invention was made to use the membrane of Waite ('553) in an apparatus intended for softening potable water to remove high levels of divalent ion salts at a higher flux, as suggested by 'Waite. Or alternatively use in conventional water treatment systems as pretreatment to reverse osmosis membranes, as disclosed in '479. The operating pressure is also disclosed in '553 (column 22, lines 44-50). Reference to Raman et al is cumulative as teaching conventional nanofiltration membranes, its rejection level, charges, use in water softening (entire article, pages 69-74).

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***Response to Arguments***

5. Applicant's arguments filed 7/20/02 have been fully considered but they are not persuasive. The rejection above was discussed in paper no. 3, and further discussed during the personal interview of 5/3/02, and is maintained. Rejections over Caloundra ('479) and Cluff ('583) are discussed separately, since the rejection before was not based in the combination of references as argued by Applicant, but on alternative teachings. Applicant argues that the membrane used in the system and process of the present invention a high water flux is produced. Applicant's apparatus (invention of claims 1 and 16) are directed to a the apparatus comprising "at least one nanofiltration", and the apparatus having "the capability" (as interpreted by the Examiner", of discharging an output of permeate water comprising at least 80 % of the input flow. The apparatus having more than one membrane in parallel will be capable of handling larger volumes of water, and therefore producing larger total flux of permeate. In the claims the flux is not claimed as a property of a single membrane in the system, but multiple membranes in any order of arrangement, e.g. parallel and/or series, is claimed, therefore, higher purity or higher flux can be expected by one skilled in the art at the time the invention was made, by the modifying the system of '479 or '583), or the combination of references discussed above. As to arguments with respect to Cluff, the apparatus of claims 1-30 is not limited to a particular process, but to the apparatus structure, and can be use with any source of water. Regarding claims 15, 30 and 40, the water

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product properties claimed or water can be found in water produced by any other process or apparatus, the product does not depend on the process or the apparatus structure, and their rejection is maintained. Furthermore, in specification, page 11, second paragraph, applicant's admits the membrane as conventional membrane (TFC-SR1), as having high flux and divalent salt rejection at low concentration of chloride. Therefore, the use of the membrane in water treatment is suggested by the manufacturer of the membrane, and the apparatus for loading membranes having a housing, inlet and outlet and feed are also known in the art. Regarding claims 10 and 33, the salt retention levels of the nanofiltration membrane seems to be inherent of the NF-70 membrane use in Caloundra's and Cluff's references, since both reject 80 % of the scale ions, e.g. calcium, magnesium and sulfate. Higher scale rejection can be obtained by providing the apparatus with more than one membrane in series for treatment of permeate in series.

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CAR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CAR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however,



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will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ana Fortuna whose telephone number is (703) 308-3857. The examiner can normally be reached on Monday-Friday from 9:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wanda Walker, can be reached on (703) 308-0457. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9310 for regular responses, and (703)872-9311 for after finals.

Ana Fortuna

October 19, 2002



**ANA FORTUNA**  
**PRIMARY EXAMINER**